C44P/C20A Series, 250 – 1,000 VAC, 400 – 1,400 VDC, for PFC and AC Filter

Electronic Components
KEMET
CHARGED®

Overview

The C44P/C20A Series are a polypropylene metallized film with cylindrical aluminium can type filled with oil, screw terminals, plastic insulator and overpressure safety device.

Applications

Typical applications include commutation, power factor correction and AC harmonic filtering.

Benefits

- Overpressure safety device
- High peak current capability
- High torque screw terminals with plastic insulator
- Long lifetime
- Self-healing

Part Number System

C	44	P	F		G	R	6	1	0	0	A	A	S	J
Series		Application	Rated Voltage (VAC)		Case Type	Terminal Style	Capacitance Code (pF)				Internal Code	Internal Codes		Tolerance
MKP Capacitors for Power Applications	44 = 250/440 V_{ac} 20 = 550/1,000 V_{ac}	AC Filter P = C44 A = C20	**For C44P:** F = 250 L = 330 K = 440	**For C20A:** K = 550 L = 640 Q = 780 Z = 1000	G = M12 bolt	R = Male M10	Digits 9, 10, & 11 indicate the first 3 digits of capacitance value. Digit 8 indicates the number of zeros that must be added to obtain rated capacitance in pF.				A = Standard Z = Special			J = 5% K = 10%

It is not possible to manufacture every part number which could be created from coding description. Please refer to table of standard part numbers and ask KEMET for other possibilities.

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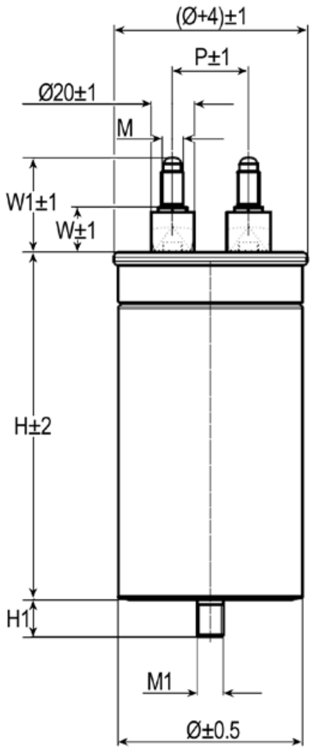
Dimensions – Millimeters



Diameter	P	W	W1	M1	H1
Ø = 65	28	18	40	12	16
Ø ≥ 75	35	21	45	12	16
All dimensions are in mm					

Maximum Driving Torque	
Terminals M10	10 [N*m]
Bolt M12	12 [N*m]

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General Technical Data

Reference Standards	IEC 61071
	UL810 approved
Dielectric	Polypropylene film
	Non-inductive type winding
Climatic Category	25/70/56 – IEC 60068-1
Maximum hot spot temperature	+80°C
Endurance Test IEC 61071	+70°C @ Case Temperature
Installation	Whatever position
Tinned brass deck with self estinguish UL94 V0 plastic insulators	

Electrical Characteristics

Rated Voltage	Urms = (see table) VAC
Surge Voltage	Us = (see table) VDC
Capacitance Tolerance	±5% or ±10%
Dissipation Factor PP typical (tgδ0)	≤ 0.0002 at 25°C
Relative Humidity	Annual average £ 80% at 24°C
	On 30 days/year permanently 100%. on other days occasionally 90%.
	Dewing not admitted
Capacitance deviation in temperature range (-40 +50°C)	±1.5% maximum on capacitance value at 20°C

Life Expectancy

Life Expectancy	100,000 hours @ V_{RMS} with T_{HS} ≤ 75°C
Capacitance drop at end of life	- 5% (typical)
Failure Rate IEC 61709	See FIT Graph

Test Methods

Test voltage term to term (Utt)	1.5 x V_{RMS} for 10 seconds at 25°C
Test voltage term to case (Utc)	3,600 V ~ 50 Hz for 10 seconds (C44P)
	6,000 V ~ 50 Hz for 10 seconds (C20A)
Damp Heat	IEC 60068-2-78
Change of Temperature	IEC 60068-2-14
Vibration Strength	IEC 60068-2-6

NOTICE: Care should be taken to ensure that there still is electrical clearance of 15 mm between terminations and other live or earthed parts above the capacitor, in case of safety device activation.

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Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production.

In Europe (RoHS Directive) and in some other geographical areas like China, legislation has been put in place to prevent the use of some hazardous materials, like Lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products to fulfill these legislative requirements. The only material of concern in our products has been Lead (Pb), which has been removed from all designs to fulfill the requirement of containing less than 0.1% of Lead in any homogeneous material.

KEMET will closely follow any changes in legislation world wide and makes any necessary changes in its products, whenever needed. Some customer segments like Medical, Military and Automotive Electronics may still require the use of Lead in electrode coatings. To clarify the situation and distinguish products from each other, a special symbol is used on the packaging labels for RoHS compatible capacitors.

Because of customer requirements there may appear additional markings like LF = Lead Free or LFW = Lead Free Wires on the label.

All KEMET power film products are RoHS Compliant.

RoHS Compliant

Materials & Environment

The selection of materials used by KEMET for the production of capacitors is the result of extensive experience and constant attention to environmental protection. KEMET selects its suppliers according to ISO 9001 standards and carries out statistical analysis on the materials purchased before acceptance. All materials are, to the company's present knowledge, non-toxic and free from Cadmium, Mercury, Chrome and compounds, PCB (Polychlorine Triphenyl), Bromide and Chlorine Dioxins Bromurate Clorurate, CFC and HCFC and Asbestos.

Green Products

All KEMET power film products are ROHS Compliant.

Insulation Resistance

When the capacitor temperature increases, the insulation resistance decreases. This is due to increased electron activity. Low insulation resistance can also be the result of moisture trapped in the windings, caused by a prolonged exposure to excessive humidity.

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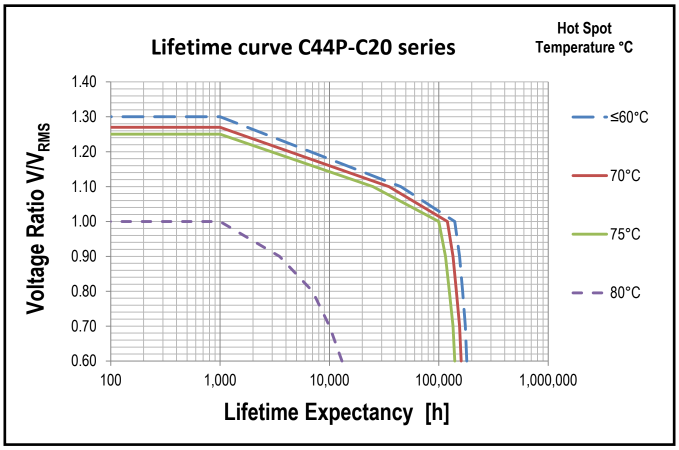
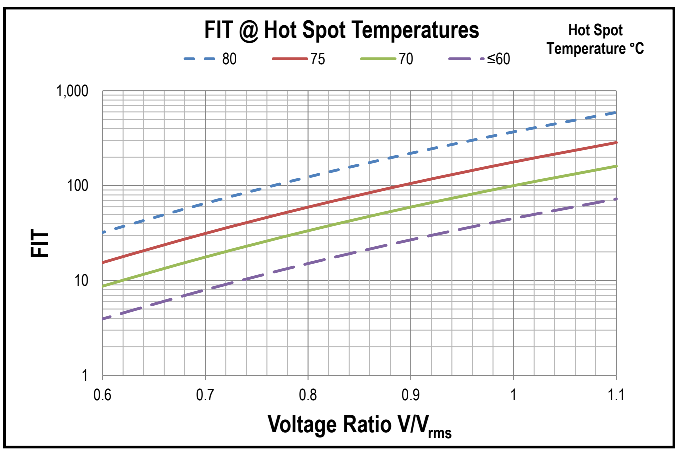
Lifetime Expectancy/Failure Quota Graphs



V = Operating Voltage [VAC]
V_{rms} = Rated Voltage [VAC]



Power Losses and Hot Spot Temperature Calculation

At each frequency, the Power Losses are the sum of:

1. Dielectric Power Losses

$P_D(f_i) = 2 * \pi * f_i * C * V(f_i)^2 * tg\delta_0$

which can be alternatively calculated as

$$P_D(f_i) = \frac{I(f_i)^2}{2 * \pi * f_i * C} * tg\delta_0$$

where: $tg\delta_0 = 2 * 10^{-4}$

2. Joule Power Losses:

$P_J(f_i) = Rs * I(f_i)^2$

The Total Power Losses are the sum of the components at each frequency:

$$P_T = \sum_i [P_D(f_i) + P_J(f_i)]$$

The Thermal Jump in the Hot Spot is:

$\Delta T_{HS} = P_T * R_{th\text{-}hs}$

The Hot Spot Temperature is:

$T_{HS} = T_a + \Delta T_{HS}$

Limits for the formulas

The limits listed below should not be exceeded:

1. $\sqrt{\sum_i V(f_i)^2} \le V_{RMS}$

2. $\sqrt{\sum_i I(f_i)^2} \le I_{RMS}$

$T_{HS} = T_a + \Delta T_{HS} \le (T_{HS})_{MAX}$

Where T_a is the ambient temperature (steady state temperature of the cooling air flowing around the capacitor, measured at 100 mm of distance from the capacitor and at a height of 2/3 height of the capacitor).

3. Maximum case temperature (T_{CASE}) ≤ 70°C

Example of calculation

Part Number: C44PKGR6100AASJ
Rated V_{RMS} = 440 [V_{RMS}]
Rated I_{RMS} = 30 [A]
R_s = 3.5 [mΩ]
R_{th} = 5.6 [°C/W]
Fundamental Frequency F_1 = 50 [Hz]
Ripple Frequency F_2 = 7000 [Hz]
Fundamental Voltage V_1 = 440 [V~]
Ripple Current I_2 = 27 [A]
T_a = 35°C
$I_1 = I(50) = 2 * \pi * 50 * 100 * 10^{-6} * 440 = 13.8$ [A]
$V_2 = V(7000) = [27/(2 * \pi * 7000 * 100 * 10^{-6})] = 6.14$ [V]

$I_{RMS} = \sqrt{(13.8^2 + 27^2)} = 30 \le 30$ → Admitted
$V_{RMS} = \sqrt{(440^2 + 6.1^2)} = 440 \le 440$ → Admitted
$P_D(50) = 2 * \pi * 50 * 100 * 10^{-6} * 440^2 * 2 * 10^{-4} = 1.22$ [W]
$P_D(7000) = [27^2/(2 * \pi * 7000 * 100 * 10^{-6})] * 2 * 10^{-4} = 0.03$ [W]
$P_J(50) = 3.5 * 10^{-3} * [(2 * \pi * 50 * 100 * 10^{-6} * 440)^2] = 0.67$ [W]
$P_J(7000) = 3.5 * 10^{-3} * 27^2 = 2.55$ [W]
$P_T = 1.22 + 0.03 + 0.67 + 2.55 = 4.47$ [W]
$\Delta T_{HS} = 5.6 * 4.47 = 25$ [°C]
$T_{HS} = Ta + \Delta T_{HS}$
$T_{HS} = 35 + 25 = 60$ [°C] →OK since hot spot temperature is less than maximum admitted
Expected Life @ T_{HS} = 75°C → 100,000 hours (see lifetime curve)
Expected Life @ T_{HS} = 60°C → 140,000 hours (see lifetime curve)

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Table 1 – Ratings & Part Number Reference

Cap Value (μF)	V_{rms}	Rated Voltage	Surge Voltage	Maximum Dimensions (mm)		Ripple Current	ESR	ESL	Thermal Res	dV/dt (V/μs)	Part Number
	VAC	VDC	VDC	D	H	10 kHz 40°C (A)[1]	10 kHz (mΩ)	(nH)	(°C/W)		
100	330	700	1050	65	117	25	3.0	115	8.5	12.5	C44PLGR6100AASJ
200	330	700	1050	65	147	43	2.8	140	5.4	12.5	C44PLGR6200ZASJ
300	330	700	1050	65	247	50	2.3	150	3.6	12.5	C44PLGR6300ZASJ
300	330	700	1050	75	197	55	1.4	160	4.2	12.5	C44PLGR6300AASJ
400	330	700	1050	65	247	55	2.0	160	3.1	12.5	C44PLGR6400ZASJ
500	330	700	1050	75	247	58	1.8	170	2.9	12.5	C44PLGR6500ZASJ
500	330	700	1050	85	197	63	1.2	160	3.4	12.5	C44PLGR6500ZBSJ
600	330	700	1050	85	247	65	1.6	180	2.9	12.5	C44PLGR6600AASJ
600	330	700	1050	85	280	75	1.1	210	2.4	12.5	C44PLGR6600ZASJ
100	440	1000	1500	75	147	30	3.5	145	5.6	20	C44PKGR6100AASJ
100	440	1000	1500	65	197	50	2.3	135	4.4	20	C44PKGR6100ZASJ
120	440	1000	1500	65	197	50	1.8	165	4.2	20	C44PKGR6120AASJ
133	440	1000	1500	65	247	40	3.0	155	3.7	20	C44PKGR6133AASJ
133	440	1000	1500	75	197	50	1.6	170	4.0	20	C44PKGR6133ZASJ
150	440	1000	1500	65	247	45	2.8	160	3.5	20	C44PKGR6150AASJ
200	440	1000	1500	75	247	55	2.4	175	3.2	20	C44PKGR6200AASJ
250	440	1000	1500	85	247	60	2.0	175	3.4	20	C44PKGR6250AASJ
300	440	1000	1500	85	247	60	1.9	180	2.7	20	C44PKGR6300AASJ
400	440	1000	1500	95	247	65	1.7	200	2.5	20	C44PKGR6400AASK
22	550	1280	1900	65	117	40	2.1	125	13.3	30	C20AKGR5220AASK
33	550	1280	1900	75	117	45	1.6	130	10.6	30	C20AKGR5330AASK
47	550	1280	1900	65	197	50	1.4	135	7.8	30	C20AKGR5470AASK
68	550	1280	1900	65	247	55	1.7	145	6.2	30	C20AKGR5680AASK
100	550	1280	1900	75	247	60	1.4	160	5.2	30	C20AKGR6100AASK
120	550	1280	1900	85	247	60	1.3	165	4.6	30	C20AKGR6120AASK
150	550	1280	1900	95	247	60	1.2	180	4.4	30	C20AKGR6150AASK
15	640	1400	2100	65	117	35	2.5	120	14.1	30	C20ALGR5150AASK
22	640	1400	2100	65	147	35	3.0	125	10.9	30	C20ALGR5220AASK
33	640	1400	2100	75	147	40	2.2	135	9.1	30	C20ALGR5330AASK
47	640	1400	2100	65	247	55	1.9	145	6.3	30	C20ALGR5470AASK
68	640	1400	2100	75	247	60	1.6	160	5.3	30	C20ALGR5680AASK
100	640	1400	2100	95	247	60	1.3	170	4.4	30	C20ALGR6100AASK
120	640	1400	2100	95	247	60	1.3	175	4.1	30	C20ALGR6120AASK
150	640	1400	2100	116	247	60	1.2	180	3.8	30	C20ALGR6150AASK
10	780	1700	2500	65	117	30	3.0	130	14.1	70	C20AQGR5100AASK
15	780	1700	2500	75	147	35	3.6	135	10.1	70	C20AQGR5150AASK
22	780	1700	2500	75	147	40	2.7	140	8.9	70	C20AQGR5220AASK
33	780	1700	2500	85	147	50	2.0	150	7.6	70	C20AQGR5330AASK
47	780	1700	2500	75	247	55	1.8	160	5.2	70	C20AQGR5470AASK
68	780	1700	2500	85	247	60	1.5	170	4.5	70	C20AQGR5680AASK
100	780	1700	2500	95	247	60	1.3	180	4.0	70	C20AQGR6100AASK
15	1000	2300	3300	75	147	33	2.5	150	9.2	85	C20AZGR5150AASK
20	1000	2300	3300	75	140	40	2.1	150	8.3	85	C20AZGR5200ZBSK
22	1000	2300	3300	75	147	35	2.0	155	8.0	85	C20AZGR5220AASK
33	1000	2300	3300	75	247	40	1.7	165	5.3	85	C20AZGR5330AASK
47	1000	2300	3300	85	247	45	1.4	170	4.7	85	C20AZGR5470AASK
68	1000	2300	3300	95	247	55	1.2	180	4.1	85	C20AZGR5680AASK
Cap Value	VAC	Rated	Surge	D	H	Ripple Current	ESR	ESL	Thermal Res	dV/dt (V/μs)	Part Number

[1] *Maximum admissible RMS current $T_{HS} \leq 75°C$.*

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Dissipation Factor

Dissipation factor is a complex function involved with the inefficiency of the capacitor. The tgδ may change up and down with increased temperature. For more information, please refer to Performance Characteristics.

Sealing

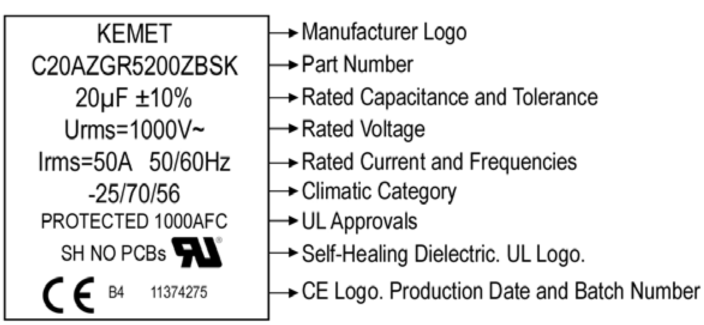
Hermetically Sealed Capacitors
When the temperature increases, the pressure inside the capacitor increases. If the internal pressure is high enough, it can cause a breach in the capacitor which can result in leakage, impregnation, filling fluid or moisture susceptibility.

Resin Encased/Wrap & Fill Capacitors
The resin seals on resin encased and wrap and fill capacitors will withstand short-term exposure to high humidity environments without degradation. Resins and plastic tapes will form a pseudo-impervious barrier to humidity and chemicals. These case materials are somewhat porous and through osmosis can cause contaminants to enter the capacitor. The second area of contaminated absorption is the lead-wire/resin interface. Since resins cannot bond 100% to tinned wires, there can be a path formed up to the lead wire into the capacitor section. Aqueous cleaning of circuit boards can aggravate this condition.

Barometric Pressure
The altitude at which hermetically sealed capacitors are operated controls the voltage rating of the capacitor. As the barometric pressure decreases, the susceptibility to terminal arc-over increases. Non-hermetic capacitors can be affected by internal stresses due to pressure changes. This can be in the form of capacitance changes or dielectric arc-over as well as low insulation resistance. Heat transfer can also be affected by altitude operation. Heat generated in operation cannot be dissipated properly and can result in high RI2 losses and eventual failure.

Radiation
Radiation capabilities of capacitors must be taken into consideration. Electrical degradation in the form of dielectric embitterment can take place causing shorts or opens.

Marking



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KEMET Corporation World Headquarters

2835 KEMET Way
Simpsonville, SC 29681

Mailing Address:
P.O. Box 5928
Greenville, SC 29606

www.kemet.com
Tel: 864-963-6300
Fax: 864-963-6521

Corporate Offices
Fort Lauderdale, FL
Tel: 954-766-2800

North America

Southeast
Lake Mary, FL
Tel: 407-855-8886

Northeast
Wilmington, MA
Tel: 978-658-1663

Central
Novi, MI
Tel: 248-306-9353

West
Milpitas, CA
Tel: 408-433-9950

Mexico
Guadalajara, Jalisco
Tel: 52-33-3123-2141

Europe

Southern Europe
Paris, France
Tel: 33-1-4646-1006

Sasso Marconi, Italy
Tel: 39-051-939111

Central Europe
Landsberg, Germany
Tel: 49-8191-3350800

Kamen, Germany
Tel: 49-2307-438110

Northern Europe
Bishop's Stortford, United Kingdom
Tel: 44-1279-460122

Espoo, Finland
Tel: 358-9-5406-5000

Asia

Northeast Asia
Hong Kong
Tel: 852-2305-1168

Shenzhen, China
Tel: 86-755-2518-1306

Beijing, China
Tel: 86-10-5829-1711

Shanghai, China
Tel: 86-21-6447-0707

Taipei, Taiwan
Tel: 886-2-27528585

Southeast Asia
Singapore
Tel: 65-6586-1900

Penang, Malaysia
Tel: 60-4-6430200

Bangalore, India
Tel: 91-806-53-76817

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(2) Prototype samples are not qualified parts and are provided "as-is" by KEMET Electronics Corporation, which specifically disclaims any and all warranties and guarantees, explicit or implied, including, without limitation, the warranties of merchantability and fitness for a particular purpose or use.
(3) Prototype samples are not intended for commercial use; are provided for engineering evaluation only and are not recommended for use in the Customer's production line.

(4) The Customer assumes the risk ofany and alluses that the Customer makes of the prototype samples.

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